KUMARAGURU
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Register Number:……..….

M.E DEGREE EXAMINATIONS: JAN 2015

(Regulation 2014)

First Semester

ENERGY ENGINEERING

P14EET101: Advanced Thermodynamics

(Use of approved charts are permitted)

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Goals of engineering thermodynamics are [K_3]

   a) To optimize methods for converting various forms of energy into work
   b) To optimize the use of work interactions so bring about desired results
   c) To minimize the loss in work of potential of a system even in the absence of work interactions
   d) All of the above

2. Second law effectiveness is ratio between [K_1]

   i. Useful availability out ii. Availability in iii. Rate of availability
   iv. Availability destruction

   a) i & iii
   b) i & ii
   c) ii & iii
   d) iii & iv

3. Which of the following is not an equation of state [K_1]

   a) Red lich –Kwang equation
   b) Pong-Robinson equation
   c) Joule-Thomson equation
   d) Mortin-Hou equation

4. The property specific volume is fairly insensitive to pressure at relatively low pressures for the following [K_3]

   a) Solids
   b) Liquids
   c) Solids & liquids
   d) Gases & liquids

5. Exothermic reactions _____ energy [K_1]

a) Absorb b) Release

c) Increases d) Decreases

6. The dissociation reactions in hydrocarbon combustion are [K_1]

a) Endothermic b) Exothermic

c) Adiabatic combustion d) Constant volume combustion

7. Classical statical model K_1

a) Ignores the possibility of different types of quantum states having same energy b) Considers the possibility of different types of quantum states having same energy

c) Ignores the possibility of different types of quantum states having different energy d) Considers the possibility of different types of quantum states having different energy

8. A function related to the specific way particles are partitioned among various energy states accessible to them is called [K_1]

a) Thermodynamic probability b) Degeneracy

c) Bose Einstein statistics d) Partition function

9. The atomic mass of oxygen is [K_1]

a) 12 b) 16

c) 32 d) 14

10. In Peltier effect the heat flux is due to [K_2]

a) Two dissimilar metals and not due to I^2R b) I^2R and not due to two dissimilar metals

c) both Two dissimilar metals and I^2R d) Electric current

PART B (10 x 2 = 20 Marks)

11. Describe the throttling process with an example [K_2]
12. Define second law efficiency [K_1]
13. Demonstrate the use of fugacity coefficient [K_2]
14. Discuss the principle of corresponding states [K_2]
15. Define enthalpy of formation [K_1]
16. What do you mean by adiabatic combustion temperature? [K_1]

17. What is degenerate? [K_1]

18. Compare microstates and macro states [K_4]

19. Write the Onsagar reciprocity relation [K_1]

20. Discuss the peltier effect [K_2]

PART C (6 x 5 = 30 Marks)

21. CO_2 is compressed adiabatically in a piston cylinder from 10 bar and 300k to 50 bar and 450k. The fluid is modeled as an ideal gas. For the ideal gas model determine 1) Availability change 2) irreversibility 3) second law effectiveness [K_2]

22. Explain second law efficiency of steady flow systems [K_2]

23. Determine the fugacity in bars for Ref-134a(R-134a) at 90^{o}C and 10 bars by means of Redlich-kwang equation of state [K_4]

24. Apply the equilibrium criteria to chemical reactions [K_3]

25. Discuss Bose-Einstein statistics [K_2]

26. Calculate the number of ways of arranging six indistinguishable balls in four distinguishable boxes [K_4]

PART D (4 x 10 = 40 Marks)

27. Evaluate the importance of Joule Thomson effect with examples [K_5]

28. Explain the microscopic interpretation of heat and work [K_2]

29. One kmol of carbon at 25^{o}C and 1 atm is burned steadily with 1 kmol of oxygen at the same state. The CO_2 formed during the process is then brought to 25^{o}C and 1 atm, the conditions of the surroundings. Assuming the combustion is complete, determine the reversible work for this process [K_4]

30. Determine the adiabatic flame temperature for liquid octane burning with 200% theoretical air at 298k [K_4]

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